



## Selecting the cost effective treatment option for prioritized pharmaceuticals

Andersen, Henrik Rasmus; Hey, G.; Rodríguez-Vega, S.; Falås, P.; Antoniou, Maria; Hörsing, M.; Ledin, A.; la Cour Jansen, J.

*Published in:*  
Book of Abstracts

*Publication date:*  
2012

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Andersen, H. R., Hey, G., Rodríguez-Vega, S., Falås, P., Antoniou, M., Hörsing, M., Ledin, A., & la Cour Jansen, J. (2012). Selecting the cost effective treatment option for prioritized pharmaceuticals. In *Book of Abstracts: IWA Regional Conference on Wastewater Purification & Reuse* IWA Publishing. <http://www.wwpr2012.gr/>

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# SELECTING THE COST EFFECTIVE TREATMENT OPTION FOR PRIORITIZED PHARMACEUTICALS

H. R. Andersen (Assoc. Professor)\*, G. Hey (PhD-fellow)\*\*, S. Rodríguez-Vega (Assist. Professor)\*\*\*, P. Falås (PhD-fellow)\*\*, M. G. Antoniou (Post-doc)\*, M. Hörsing (Postdoc)\*\*, A. Ledin (Professor)\*\*, J. la Cour Jansen (Professor)\*\*.

\*Technical University of Denmark (DTU), Department of Environmental Engineering, Miljøvej, Building 113, 2800 Kgs. Lyngby, Tel: +45 45251583; email: [hran@env.dtu.dk](mailto:hran@env.dtu.dk)

\*\*Water and Environmental Engineering at the Department of Chemical Engineering, Lund University, SE-221 00 Lund, Sweden

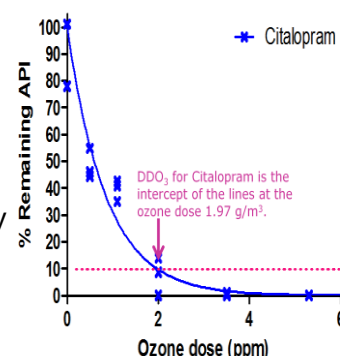
\*\*\*Department Ingeniería Química, Facultad Químicas, Universidad Complutense, 28040 Madrid, Spain

## EXECUTIVE SUMMARY

The presence of active pharmaceutical ingredients (APIs) in municipal wastewater treatment plants (WWTPs) is considered to be the main source of contamination of water resources. The potential side effects that APIs can cause to wild life and humans from chronic exposure, necessitates their efficient removal from wastewater effluents prior discharge. The emerging solution to this problem for the environment is to implement an advanced targeted treatment for micropollutants at WWTPs. The most promising solutions in terms of effectiveness and economy are oxidation method, particularly ozone and chlor dioxide, and use of sorbents, particularly powder activated carbon. Each treatment has different effectiveness for each API so it is not directly possible to select one optimal method for all APIs and therefore in practice the choice of method will depend on the list of prioritised chemicals which it is required to remove.

In our comparison procedure we first consider the removal of each APIs by biodegradation that can be expected based on the treatment insensitivity and removal by sorption to sludge.

Our concept of comparing the effect of different advanced treatments is to model, based on experimental data from laboratory scale studies, the treatment dose which removed 90 % of the concentration of each API. We have named this parameter: Decadic removal Dose, DD. Since most of the applied treatment



chemical or sorbent is wasted on the bulk organic carbon in the wastewater and only a small fraction actually reacts with API, this concept is almost independent of the API concentration.

In the Mistrapharma project decadic doses (g/m<sup>3</sup> per 1.st order of API removal) were determined for 50-75 commonly occurring APIs in wastewater effluents for alternative polishing methods.

Powder Activated Carbon	API	Decadic Dose of PAC		Cost: 25 kr/kg	
	Diclofenac	3.5 g/m <sup>3</sup>		0.088 kr/m <sup>3</sup>	
	Ethinylestradiol	1 g/m <sup>3</sup>		0.025 kr/m <sup>3</sup>	
	Ibuprofen	<50 mg/m <sup>3</sup>		<0.001 kr/m <sup>3</sup>	
Chlorine dioxide	API	Decadic Dose of ClO <sub>2</sub> (g/m <sup>3</sup> )		Cost: 50 kr/kg	
		Low COD	High COD	Low COD	High COD
	Diclofenac	1	2.5	0.05 kr/m <sup>3</sup>	0.13 kr/m <sup>3</sup>
	Ethinylestradiol	1	2.5	0.05 kr/m <sup>3</sup>	0.13 kr/m <sup>3</sup>
Ozone	API	Decadic Dose of O <sub>3</sub> (g/m <sup>3</sup> )		Cost: 20 kr/kg	
		Low COD	High COD	Low COD	High COD
	Diclofenac	4.5	11	0.09 kr/m <sup>3</sup>	0.22 kr/m <sup>3</sup>
	Ethinylestradiol	2	5	0.04 kr/m <sup>3</sup>	0.10 kr/m <sup>3</sup>
	Ibuprofen	9	10	0.18 kr/m <sup>3</sup>	0.20 kr/m <sup>3</sup>

Depending on the biological treatment and the APIs selected to be critical, each type of the additional treatments considered can be the best choice.